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Sir: Transmitted herewith for filing is the patent application of:

Inventor: T. KAWASAKI et al (See Attached List)

For:  
RADIOACTIVE WASTE TREATMENT FACILITY

Enclosed are:

☐

5 Sheets of Drawings

☐

This application is being filed without an executed Declaration.

☒

Priority is claimed from Japanese Application No. 11-356466  
filed December 15, 1999 ☐ A certified copy is attached herewith.

☒

Copies of the disclosure documents listed on the attached PTO 1449 form and  
☒ discussed in the specification or ☐ attached Information Disclosure Statement.

☐

A verified statement to establish small entity status under 37 CFR 1.9 and 1.27.

☒

Specification: Abstract ☒ X, Description 26 pages; and 4 claim(s).

☐

Preliminary Amendment.

☒

Executed Declaration.

The filing fee is calculated as shown below:

Small Entity

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For:	No. Filed	No. Extra
Basic Fee		
Total Claims	4 - 20 = *	0
Indep Claims	1 - 3 = *	0
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Rate	Fee
	\$ 345
x 9	\$
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Rate	Fee
	\$ 690
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A check in the amount of \$ 690.00 is enclosed for the filing fee.

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The Commissioner is hereby authorized to charge any additional fees that may be required to  
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Respectfully Submitted,

By: 

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## RADIOACTIVE WASTE TREATMENT FACILITY

5           The present invention relates to a radioactive waste treatment facility for solidification of radioactive waste, which is generated from radioactive material handling facilities such as nuclear power plants, fuel reprocessing plants, and the like.

15 processing, not only the volume of the radioactive waste  
can be reduced, but also stable a solidified waste superior  
in long term duration can be obtained.

20 as miscellaneous solidwaste, concentrated liquid waste,  
spent resin, ashes, and others. Respective of the groups  
is handled with an appropriate treating method of injecting  
solidification or kneading solidification depending on  
its kind and properties.

25           The injecting solidification is a method, in which  
the waste is contained in a drum first, and then, a  
solidifying agent is injected into the drum from the top  
of the drum for solidification. The injecting

5           The kneading solidification is a method, in which  
the waste is solidified by kneading with a solidifying  
agent. The kneading solidification method is applied to  
powder, granular, or liquid waste such as concentrated  
liquid waste and its dried powder, spent resin, ashes, and  
10 the like. At this time, there are in-drum type and  
out-drum type for the kneading method. The in-drum type  
method is a method, in which, after charging the waste and  
a solidifying agent together into a solidifying container  
(or during charging), a kneading blade is inserted into  
15 the charged materials to knead them. The out-drum type  
method is a method, in which, after charging the waste and  
a solidifying agent together into an exclusive kneading  
container and kneading the charged materials by inserting  
a kneading blade therein, the kneaded material is poured  
20 into a solidifying container.

In order to solve the above problem, a radioactive

waste treatment facility (solidification facility) comprising; a transferring means for transferring solidifying containers; an out-drum mixer type kneader which is capable of preparing kneaded material by charging  
5 a solidifying agent, additive water, and the radioactive waste together therein and kneading them; and a kneaded material injecting means, which injects the kneaded material into a solidifying container at a designated location in the transferring direction of the transferring  
10 means; is disclosed in JP-A-8-29594 (1996).

In accordance with the radioactive waste treatment facility, when performing the injection and solidification of the radioactive miscellaneous solid waste and others, a solidifying container wherein the  
15 radioactive waste is supplied previously is transferred to a designated location by the transferring means; only the solidifying agent and the additive water are charged into the kneader to prepare a solidifying agent paste; and the solidifying agent paste is injected into the  
20 solidifying container by the kneaded material injecting means. Accordingly, the solidifying agent paste is flowed down through the intervals among the solid waste to be filled into the solidifying container, and a solidified waste as same as the one obtained by a normal injecting  
25 solidification method can be prepared.

On the other hand, when concentrated liquid waste, spent resin, ashes, and the like are solidified by the kneading solidification, a solidified waste (homogeneous

solidified waste), wherein the solidifying paste and the radioactive waste are mixed thoroughly, as same as the one obtained by a normal injecting solidification method can be prepare by the steps of: transferring an empty  
5 solidifying container to a designated location by the transferring means; charging a solidifying agent, additive water, and the radioactive waste into a kneading vessel of the kneader; agitating the charged material with kneading blade to form a kneaded material; and injecting  
10 the kneaded material into the solidifying container by the kneaded material injecting means.

In accordance with the prior art described above, kneading the solidifying paste (solidifying agent + additive water) for kneading solidification, and kneading  
15 the kneaded material for kneading solidification are performed by a similar out-drum-mixer type kneader, in order to make it possible to perform injecting solidification and kneading solidification together by a single facility.

20 However, in accordance with the above prior art, the following problems are still remained to be solved.

That is, the radioactive waste treating (solidification) facility must be cleaned up after completing a designated treatment. At that time, the  
25 portions touched with the radioactive water are contaminated with radioactive material, and washed water of the portions become secondary radioactive waste and another treating facility for the secondary radioactive

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waste becomes necessary. Accordingly, in the radioactive waste treating (solidification) facility, it is preferable that the portions touched with radioactive waste must be reduced as small as possible.

5           Generally, in case of out-drum type kneader is used in the kneading solidification, both the kneading blade and the kneading vessel are contaminated with radioactive material, and both of them must be washed. On the contrary, in case of in-drum type kneader is used, only the kneading  
10   blade is contaminated. Therefore, only the kneading blade must be washed, and the amount of secondary radioactive material can be reduced.

          In accordance with the prior art, the out-drum mixer type kneader is used, in order to make it possible to  
15   perform injecting solidification and kneading solidification together by a single facility. Accordingly, both the kneading blade and the kneading vessel are contaminated with radioactive material in the kneading solidification operation, and both of them must  
20   be washed. Therefore, the amount of the secondary radioactive waste can be hardly reduced.

#### SUMMARY OF THE INVENTION

          One of the objects of the present invention is to  
25   provide a radioactive waste treatment facility, which can perform both the injecting solidification and the kneading solidification together by a single facility, and makes it possible to reduce the generating amount of the



secondary radioactive waste.

(1) In order to achieve the above object, the radioactive waste treatment facility of the present invention comprises;

5 a transferring means for transfer a solidifying container;

a solidifying agent kneading and injecting means for preparing a solidifying agent paste by kneading the solidifying agent and additive water, and injecting the  
10 solidifying agent paste into the solidifying container at a first location in the upstream of the transferring direction of the transferring means; and

a waste charging and kneading means for charging the radioactive waste into the solidifying container at a  
15 second location in the downstream, in comparison with the first location, of the transferring direction of the transferring means, and kneading the radioactive waste with the solidifying paste in the solidifying container.

In accordance with the radioactive waste treatment  
20 facility of the present invention composed as described previously, when the injecting solidification of radioactive miscellaneous solid waste is performed, a solidifying container, wherein the radioactive waste is charged previously, is transferred to the first location  
25 by the transferring means, and the solidifying paste is injected into the solidifying container by the solidifying agent kneading and injecting means. Therefore, as the solidifying paste is filled into the solidifying container

by flowed down through the intervals among the radioactive waste, a solidified waste as same as the one obtained by the normal injecting solidification can be prepared.

On the other hand, when the kneading solidification  
5 of radioactive concentrated liquid waste, spent resin, ashes, and others is performed, an empty solidifying container is transferred to the first location by the transferring means, and only the solidifying paste is injected into the solidifying container by the solidifying  
10 agent kneading and injecting means. Subsequently, the solidifying container is transferred to the second location; the radioactive waste is charged into the solidifying container, wherein the solidifying paste is filled previously, by the waste charging and kneading means  
15 at the second location; and kneading is performed in the solidifying container. Accordingly, a solidified waste (homogeneous solidified waste), the solidifying paste and the radioactive waste are mixed thoroughly, as same as the one obtained by the normal injecting solidification can  
20 be prepared.

In accordance with the composition described above, the injecting solidification and the kneading solidification can be performed by a single facility, and the solidifying agent kneading and injecting means can be  
25 made the out-drum type and the waste charging and kneading means can be made in-drum type.

At that time, the solidifying agent kneading and injecting means is used for kneading only the non-

radioactive solidifying agent and the non-radioactive additive water. Therefore, the solidifying agent kneading and injecting means can be installed in an area separated by, for instance, a separation wall from the area  
5 where the waste charging and kneading means is installed. Because the liquid waste of washing is also non-radioactive, and it could be readily treated and deposited. On the other hand, the waste charging and kneading means is charged with radioactive waste when kneading and  
10 solidifying. Therefore, the liquid waste from washing the waste charging and kneading means becomes the secondary radioactive waste. However, the waste charging and kneading means can be made in-drum type, and washing is necessary only for kneading blade. Accordingly, the  
15 generating amount of the secondary radioactive waste can be reduced.

(2) In accordance with the above methods described in (1), the solidifying agent kneading and injecting means desirably comprises;

20 a kneading vessel, whereto the solidifying agent and the additive water is charged;

a first kneading blade for agitating inside of the kneading vessel;

an out-drum type kneader for preparing the  
25 solidifying agent paste; and

an injecting means for injecting the solidifying agent paste in the kneader for preparing the solidifying agent paste into the solidifying container.

(3) In accordance with the above methods described in (1), the waste charging and kneading means desirably comprises;

an elevating means for elevating the solidifying container, which has been transferred to the second location by the transferring means, upward from the transferring line of the transferring means; and

an in-drum type radioactive waste kneader, which charges the radioactive waste into the elevated solidifying container and performs kneading in the solidifying container with the second kneading blade.

(4) In accordance with the above methods described in (1), the solidifying agent injecting and kneading means is desirably provided in an area separated from the waste charging and kneading means by separating walls.

#### BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects, features and advantages of the present invention will be understood more clearly from the following detailed description with reference to the accompanying drawings, wherein,

FIG. 1 is a flow diagram for explaining the behavior at the kneading and solidifying operation of the solidifying agent kneading and injecting means and the waste charging and kneading means, which are provided in the radioactive waste solidification facility of the embodiment of the present invention,

FIG. 2 is a set of schematic illustrations indicating the transferring route of the solidifying container in the transferring mechanism, which is provided in the radioactive waste solidification facility of the embodiment of the present invention,

FIG. 3 is a schematic illustration indicating a total outline of the compositions of the solidifying agent injecting and kneading mechanism and the waste charging and kneading mechanism, which are provided in the radioactive waste solidification facility of the embodiment of the present invention,

FIG. 4 is a schematic illustration indicating the composition of the turn-table indicated in FIG. 2(a) and FIG. 2 (b), and

FIG. 5 is a flow diagram for indicating the behavior at the injecting and solidifying operation of the solidifying agent kneading and injecting means indicated in FIG. 3.

## 20 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereinafter, details of the embodiments of the present invention is explained referring to the figures 1 to 5.

The solidification facility of the present embodiment is capable of solidifying four kinds of radioactive waste, i.e. the miscellaneous solid waste, spent resin, dried powder of concentrated liquid waste, and ashes, into a solidifying container (details will be

explained later), into a solidifying container 4.

The solidification facility comprises;

a solidifying agent injecting and kneading mechanism 50 (details will be explained later) for  
5 injecting and solidifying the miscellaneous solid waste (hereinafter, called only as injecting solidification), and for injecting the solidifying agent paste at kneading and solidifying the spent resin, the dried powder of concentrated liquid waste, and the ashes (hereinafter,  
10 called only as kneading solidification);

a waste charging and kneading mechanism 60 (details will be explained later) for charging the radioactive waste and kneading at the kneading solidification;

and a transferring mechanism 5 (detail will be  
15 explained later) for transferring the solidifying container 4 (details will be explained later) selectively to the solidifying agent injecting and kneading mechanism or the waste charging and kneading mechanism depending on whether the operation is for the injecting solidification  
20 or the kneading solidification.

FIG. 2(a) and FIG. 2(b) are figures indicating the transferring route of the solidifying container 4 of the transferring mechanism 5 described above.

In accordance with FIG. 2(a) and FIG. 2(b), the  
25 transferring mechanism 5 is composed of, for instance, a plurality of rollers 50 arranged in a transferring direction (so-called roller conveyer, refer to FIG. 4); respective of the rollers is central-controlled by control

signals (not shown in the figure) from the controller 70 installed in a control room (not shown in the figure) of the solidification facility.

The transferring mechanism 5 comprises; a main  
5 transferring route 5A; a sub-start up point route 5B, which merges with the main transferring route at a point of downstream side in the transferring direction near the start up point of the main transferring route 5A; and a sub-transferring route 5C, which branches at a point of  
10 downstream side from the merging point of the sub-start up point route 5B with the main transferring route 5A, and merges again with the main transferring route at a point of further downstream side from the branching point. Respective of the turn-tables 5a<sub>1</sub>-5a<sub>5</sub>, is provided at the  
15 respective of the merging point of the main transferring route 5A with the sub-start up point route 5B, and the merging point and the branching point of the main transferring route 5A with the sub-transferring route 5C. The turn-tables are controlled automatically by the  
20 controller 70 (or manual control by inputting operation signals from the control panel to the controller 70 can be used) to switch the transferring route of the solidifying container 4 (detail will be explained later).

A sensor 80 (refer to FIG. 2) for detecting the  
25 solidifying container 4 when it is transferred is proved at the first position 5b on the main transferring route 5A (or a position before the first position 5b by a designated distance can be used). When detecting signals

(refer to FIG. 2 (a)) from the sensor 80 is transmitted to the controller 70, corresponding control signals (not shown in the figure) are output to the main transferring route 5A from the controller 70, and the solidifying

5 container is stopped once at the first position 5b. The solidifying agent injecting and kneading mechanism 50 is provided at upper position of the first position 5b. A total outline of the compositions of the solidifying agent injecting and kneading mechanism 50 is indicated in FIG.  
10 3(a).

In accordance with FIG. 3(a), the solidifying agent injecting and kneading mechanism 50 comprises;

a solidifying agent silo 11;

a solidifying agent weighing apparatus 1 for  
15 weighing the solidifying agent, which is supplied from the solidifying agent silo 11 via the solidifying agent supply valve 16;

an additive water supply line 12;

an additive water weighing apparatus 2 for weighing  
20 the additive water, which is supplied from the additive water supply line 12 via the additive water supply valve 23;

a kneader 3 for solidifying agent, which kneads the solidifying agent supplied from the solidifying agent  
25 weighing apparatus 1 through the solidifying agent supply valve 17 and the additive water supplied from the additive water weighing apparatus 2 via the additive water supply valve 18 to prepare the solidifying agent paste, and



an injection valve 19 for injecting and filling the solidifying agent paste into the solidifying container 4.

The kneader 3 for solidifying agent is out-drum type apparatus comprising a kneading vessel 3a, whereto the  
5 solidifying agent and the additive water are supplied, and a kneading blade (agitating blade) 3b driven by a motor for agitating inside of the kneading vessel 3a.

Open-close operations of the waste supply valves 24a-24c and the waste supply valves 20a-20c are controlled  
10 by control signals from the controller 70 such as electric magnet valves, but details are omitted from the figures.

The whole solidifying agent injecting and kneading mechanism 50 composed as described above is installed in an area separated from the area where the other radioactive  
15 handling apparatus and facilities such as the waste charging and kneading mechanism 60 and others by, for instance, separating walls.

A sensor 81 (refer to FIG. 2) for detecting the solidifying container 4 when it is transferred there is  
20 provided at a second location 5c (at a position before a designated distance ) in the sub-transferring route 5B (that is, at downstream side in the transferring direction from the first location) as indicated in FIG. 2 (a) and FIG. 2 (b). When the detecting signals of the sensor 81  
25 'refer to FIG. 2) is transmitted to the controller 70, corresponding control signals are output from the controller 70 to the transferring mechanism sub-transferring route 5B, and the solidifying container 4 is

stopped once at the second location 5c. The waste charging and kneading mechanism 60 is installed at the location upward the second location 5c. A whole schematic composition of the waste charging and kneading mechanism 5 60 is indicated in FIG. 3 (b).

In accordance with FIG. 3\_(b), the waste charging and kneading mechanism 60 comprise;

- waste supply lines 13a-13c for supplying radioactive waste,
- 10 waste weighing apparatus 6a-6c for weighing the radioactive waste supplied from the waste supply lines 13a-13c via the waste supply valves 24a-24c,
- a waste supply line 21 for supplying the radioactive waste, which is weighed at respective of the waste weighing
- 15 apparatus 6a-6c, via the waste supply valves 20a-20c,
- a solidifying container elevator 10 for elevating the solidifying container 4, which is transferred to the second location 5c, upwards from the transferring line 5C (refer to FIG. 1, explained later), and
- 20 a kneader 9 for kneading waste, which charges the radioactive waste supplied from the waste supply line 21 into the elevated solidifying container 4, and kneads the radioactive waste in the solidifying container 4.

The kneader 9 for kneading waste is so-called in-drum 25 type, which is provided with only kneading blade 9a (agitating blade) driven by motor for agitating inside of the solidifying container 4, and is composed so as to charge the radioactive waste supplied from the waste supply line

21 into the elevated solidifying container 4, and to knead the radioactive waste in the solidifying container 4 by dipping the kneading blade 9a therein (refer to FIG. 1, explained later).

5           The solidifying container elevator 10 comprises a base 10a; an extendable arm mechanism 10b provided with, for instance, a hydraulic cylinder; and a solidifying container platform 10c located at the second location 5c in the sub-transferring route 5C; and the solidifying  
10 container platform 10c can be elevated or lowered depending on extending-shrinking motion of the extendable arm mechanism 10b corresponding to extending-shrinking motion of the hydraulic cylinder.

          The number of the waste supply lines 13a-13c, waste  
15 supply valves 24a-24c, waste weighing apparatus 6a-6c, and the waste supply valves 20a-20c to be provided are decided depending on the number of kinds of waste to be kneaded and solidified. For instance, spent resin is supplied through the waste supply line 13a, dried powder of  
20 concentrated liquid waste is supplied through the waste supply line 13b, and ashes is supplied through the waste supply line 13c.

          The solidifying agent supply valve 16, the solidifying agent supply valve 17, the additive water  
25 supply valve 23, and the additive water supply valve 18 are controlled their open-close motion 8for instance electric magnet valve) by the control signals from the controller 70, but details are omitted in the figure.

The whole waste charging and kneading mechanism 60 composed of the apparatus as explained above is installed in a radioactivity controlled area separated from the area where the other non-radioactive handling apparatus and facilities such as the solidifying agent injecting and kneading mechanism 50 and others by the separating walls 27 (refer to FIG. 3 (a)).

FIG. 4 is a schematic illustration indicating the composition of the turn-table 5a1 indicated in FIG. 2(a) and FIG. 2 (b). The turn-table 5a is not operated for a special motion when the solidifying container 4 moves in a straight direction on the main transferring route 5A (that is, when it moves as route 5A1 → turn-table 5a1 → route 5A). However, when the moving direction must be changed (that is, when it moves as route 5A1 → turn-table 5a1 → route 5C), the turn-table is operated as follows.

That is, a sensor 82 for detecting the solidifying container 4 when it is transferred is provided at a designated position on the turn-table 5a1 (or a position at a designated distance before the designated position on the route 5A1 can be used). When a detecting signal of the sensor 82 is transmitted to the controller 70, a stop controlling signal (not shown in the figure) corresponding to the detecting signal is output from the controller 70 to the driving roller 50 on the turn-table 5a1, and the solidifying container 4 is stopped once on the turn-table 5a1.

Then, a control signal is output from the controller

70 to the driving device 83 for rotating the turn-table 5a1, and the turn-table 5a1 is rotated by 90 degrees in a direction indicated by an arrow A in FIG. 4.

After completing the rotation, a driving control  
5 signal (not shown in the figure) is output from the controller 70 to the driving roller 50 on the turn-table 5a1, and the transfer is resumed by transferring the solidifying container 4 to the sub-transferring route 5C from the turn-table 5a1.

10 Other two turn-tables 5a2, 5a3 are composed as same as above, but explanation is omitted.

As explained above, the transferring mechanism 5  
composes the transferring means for transferring the solidifying container as claimed in respective of the  
15 claims.

A first kneading blade comprises the kneading blade 3b of the kneader 3 for solidifying agent, and the injecting means for injecting the solidifying agent paste in the kneader for solidifying agent comprises the injecting  
20 valve 19.

The solidifying agent injecting and kneading means for injecting the solidifying agent paste into the solidifying container at the first location in the upstream side in the transferring direction of the transferring  
25 means comprises; solidifying agent silo 11, solidifying agent supply valve 16, solidifying agent weighing apparatus 1, solidifying agent supply valve 17, additive water supply valve 23, additive water weighing apparatus

2, additive water supply valve 18, kneader 3 for solidifying agent, and injecting valve 19.

An elevating means for elevating the solidifying container, which is transferred to the second location by the transferring means, upwards from the transferring line of the transferring means comprises the solidifying container elevator 10, and the second kneading blade comprises the kneading blade 9a of the kneader 9 for waste.

The waste charging and kneading means, which is capable of charging radioactive waste into the solidifying container at the second location in the downstream of the first location in the transferring direction of the transferring means and of kneading the radioactive waste in the solidifying container, comprises waste supply lines 13a-13c, waste supply valves 24a-24c, waste weighing apparatus 6a-6c, waste supply valves 20a-20c, waste supply lines 21, and kneader 9 for waste.

The separating wall is composed of partition walls 27.

Operation of the radioactive solidification facility composed as explained above of the present embodiment is explained hereinafter.

In accordance with the solidification facility, an instruction for switching an injecting and solidifying mode for performing the injection and solidification, and a kneading and solidifying mode for performing kneading and solidification is input at the control room, and corresponding signal is output to the controller 70. Then,

the controller 70 controls automatically respective of the apparatus so as to operate appropriately corresponding to respective of the wastes.

(1) Injection and solidification

5 When the injecting and solidifying mode is selected in the control room, the solidifying container 4 is transferred by the route indicated in FIG. 2 (a), and the solidification treatment is performed. The process is explained referring to FIG. 2 (a) and FIG. 5.

10 In accordance with FIG. 2(a), the solidifying container 4, wherein miscellaneous solid waste has been charged by operators previously, is loaded on the main transferring route 5A, and transferred to the first location 5b by the transferring mechanism 5 and stopped  
15 once.

In a condition that the solidifying container 4 is stopped at the first location 5b, an adequate amount of solidifying agent for injection and solidification of the miscellaneous solid waste is weighed by the solidifying  
20 agent weighing apparatus 1, and injected into the kneader 3 for solidifying agent. Subsequently, an adequate amount of additive water for injection and solidification of the miscellaneous solid waste is weighed by the additive water weighing apparatus 2, and injected into the kneader 3 for  
25 solidifying agent. The solidifying agent and the additive water injected into the kneader 3 for solidifying agent is kneaded under a designated condition to be the solidifying agent paste, and injected into the solidifying

container 4. The solidifying agent paste flows down through the intervals among the waste to fill the inside of the solidifying container 4. Accordingly, a solidified waste as same as the one obtained by the normal injection and solidification can be prepared.

The solidified waste of the miscellaneous solid waste obtained as above is transferred as it is on the main transferring route 5A by the transferring mechanism 5, and stored in a storage place (not shown in the figure).

(2) Kneading and solidification

When the kneading and solidifying mode is selected in the control room, the solidifying container 4 is transferred by the route indicated in FIG. 2 (b), and the solidification treatment is performed. The process is explained referring to FIG. 2 (b) and FIG. 1.

In accordance with FIG. 2(b), the solidifying container 4 starts the sub-original point 5B as it is empty, which is different from the previous (1). The solidifying container 4 loaded on the sub-original point 5B is changed its transferring direction by the turn-table 5a1 to the main transferring route 5A, and transferred to the first location 5b by the transferring mechanism 5 and stopped once.

In a condition that the solidifying container 4 is stopped at the first location 5b, an adequate amount of solidifying agent for treating the waste (hereinafter, called selected waste) selected at the control room from spent resin, dried powder of concentrated liquid waste,



and ashes is weighed by the solidifying agent weighing apparatus 1, and injected into the kneader 3 for solidifying agent, as indicated in FIG. 1. Subsequently, an adequate amount of additive water for solidification  
5 of the selected waste is weighed by the additive water weighing apparatus 2, and injected into the kneader 3 for solidifying agent. The solidifying agent and the additive water injected into the kneader 3 for solidifying agent is kneaded under a designated condition to be the  
10 solidifying agent paste having an adequate water-cement ratio and weight for kneading and solidification of the selected waste, and injected into the solidifying container 4.

The solidifying container 4 injected by the  
15 solidifying agent paste is transferred on the main transferring route 5A by the transferring mechanism 5, and changed its transferring direction by the turn-table 5a2 to the sub-transferring route 5C. The solidifying container 4 is transferred further to the second location  
20 5c on the sub-transferring route 5C, and stopped there once.

Under the condition that the solidifying container 4 is stopped at the second location 5c, the solidifying container 4 is elevated by the solidifying container  
25 elevator 10, which is installed under the kneader 9 for waste, until the upper periphery 4a (an opening portion) of the solidifying container 4 is touched with the lid portion 9b of the kneader 9 for waste. In this condition,

under agitation and kneading by driving the kneading blade 9a, a designated amount of selected waste is charged into the solidifying container 4 from the waste weighing apparatus 6a-6c corresponding to the selected waste.

5 Accordingly, a solidified waste, wherein the solidifying agent paste and the selected waste are mixed thoroughly, as same as the solidified waste (homogeneous solidified waste) obtained by the normal kneading and solidification can be prepared.

10 At this time, the kneading is continued for a designated time after completion of charging the total amount of the selected waste. After completion of the kneading, the solidifying container 4 is lowered to the level of the transferring mechanism 5 again by the  
15 solidifying container elevator 10. During the above operation, the upper periphery 4a of the solidifying container 4 and the lower plane of the lid portion 9b of the kneader for waste is contacted tightly in order to prevent the kneaded material in the solidifying container  
20 4 from splashing out.

The homogeneous solidified waste obtained as described above is transferred on the sub-transferring route 5C again, changed its transferring direction by the turn-table 5a3 on the main transferring route 5A, and  
25 transferred on the main transferring route 5A to a storage place which is not shown in the figure.

In accordance with the solidifying facility of the present embodiment, which is composed as described above,

the injection and solidification of miscellaneous solid waste and kneading and solidification of a several kinds of waste can be performed selectively by a single facility.

Furthermore, the solidifying agent injecting and  
5 kneading mechanism 50 can be made out-drum type, and the waste charging and kneading mechanism 60 can be made in-drum type.

In any cases of the above injection- solidification and kneading-solidification, the solidifying agent  
10 injecting and kneading mechanism 50 is used only for kneading the non-radioactive solidifying agent and the additive water. Therefore, the solidifying agent injecting and kneading mechanism 50 can be installed in an area separated by a partition wall 27 from the area where  
15 the waste charging and kneading mechanism 60, which is radioactive apparatus, is installed, and generated washing liquid waste can be treated and disposed readily because the liquid waste is non-radioactive. On the other hand, the waste charging and kneading mechanism 60 is  
20 radioactive because the radioactive waste is charged when kneading and solidifying, and the generated washing liquid waste becomes radioactive secondary waste. However, the waste charging and kneading mechanism 60, which is a radioactive apparatus, can be made in-drum type, and  
25 washing object is only the kneading blade 9a. Therefore, the generating amount of the radioactive secondary waste can be made small.

Generally, the solidifying agent paste prepared by

kneading the solidifying agent and the additive water has a low viscosity, but the adding the waste and kneading increases the viscosity. In accordance with the out-drum type (kneading vessel + kneading blade) kneading and solidification, the increased viscosity of the kneading material generates a possibility to choke the outlet of the kneading vessel when the kneaded material is discharged.

In accordance with the present embodiment, an advantage is realized that the choke described above can be prevented, because kneading the solidifying agent paste having a low viscosity is performed by the out-drum type solidifying agent injecting and kneading mechanism 50, and kneading the radioactive waste is performed by the in-drum type waste charging and kneading mechanism 60.

In accordance with the present embodiment, changing the transferring direction of the solidifying container 4 is performed using the turn-table 5a by turning the turn-table 5a by 90 degrees under a condition that the solidifying container is loaded on the turn-table 5a, but methods of changing the transferring direction is not restricted to the above method, and other method is usable.

That is, when the solidifying container 4 is stopped on the turn-table 5a, for instance, the solidifying container 4 is transferred to the sub-transferring route 5C by hanging the solidifying container 4 with a hanger which is provided particularly, by pushing the solidifying container 4 to the direction toward the sub-transferring

route 5C with a pusher which is provided particularly, or other transferring mechanism, which has a function to transfer the solidifying container 4 to the sub-transferring route 5C, inserted beneath driving rollers 50 of the turn-table 5a to operate between the rollers 50.

In accordance with the present invention, the injection and solidification operation and kneading and solidification operation can be performed selectively by a single facility, and generating amount of the radioactive secondary waste can be decreased.

What is claimed is;

1. A radioactive waste treatment facility comprising;  
a transferring means for transferring solidifying  
5 container,  
a solidifying agent injecting and kneading means for  
preparing a solidifying agent paste by kneading a  
solidifying agent and additive water, and injecting said  
solidifying agent paste into said solidifying container  
10 at a first location of the upstream side in a transferring  
direction of said transferring means, and  
a waste charging and kneading means, which is capable  
of charging radioactive waste into said solidifying  
container at the second location in the downstream of the  
15 first location in the transferring direction of the  
transferring means and of kneading the radioactive waste  
in said solidifying container.
2. A radioactive waste treatment facility as claimed  
20 in claim 1, wherein;  
said solidifying agent injecting and kneading  
means comprises;  
a kneading vessel, whereto the solidifying agent and  
the additive water is supplied;  
25 a first kneading blade for agitating inside of said  
kneading vessel;  
an out-drum type kneader of solidifying agent for  
preparing said solidifying agent paste; and

an injecting means for injecting said solidifying agent paste in said kneader of solidifying agent into said solidifying container.

- 5 3. A radioactive waste treatment facility as claimed in claim 1, wherein;

said waste charging and kneading means comprises;

- an elevating means for elevating said solidifying container, which has been transferred to the second  
10 location by said transferring means, upward from transferring line of said transferring means; and

- an in-drum type waste kneader, which charges radioactive waste into said elevated solidifying container and performs kneading in said solidifying  
15 container with second kneading blades.

4. A radioactive waste treatment facility as claimed in claim 1, wherein;

- said solidifying agent injecting and kneading  
20 means is installed in an area separated by partition wall from said waste charging and kneading means.

The injection and solidification operation and kneading and solidification operation can be performed selectively by a single facility, and generating amount of the radioactive secondary waste can be decreased.

A transferring means 5 for transferring solidifying container 4; a solidifying agent injecting and kneading means 50 for preparing a solidifying agent paste by kneading a solidifying agent and additive water, and injecting said solidifying agent paste into said solidifying container 4 at a first location 5b of the upstream side in a transferring direction of the transferring means 5; and a waste charging and kneading means 60, which is capable of charging radioactive waste into the solidifying container 4 at the second location 5c in the downstream of the first location 5b in the transferring direction of the transferring means 5 and of kneading the radioactive waste in the solidifying container 4; are provided.



FIG. 1

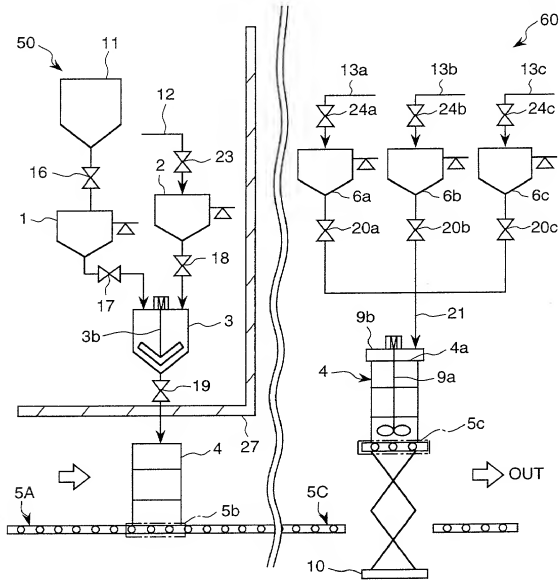


FIG. 2(a)

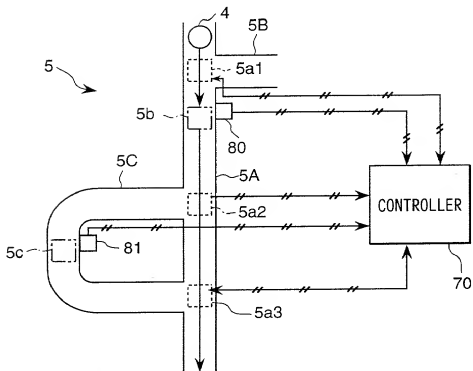


FIG. 2(b)

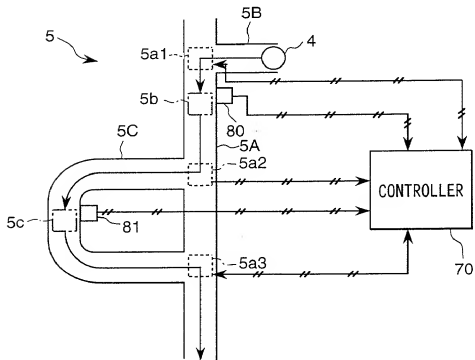


FIG. 3(a)

(NON-RADIOACTIVE APPARATUS)

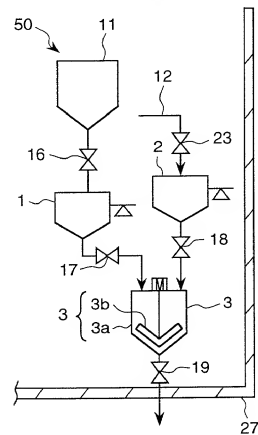


FIG. 3(b)

(RADIOACTIVE APPARATUS)

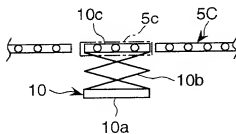
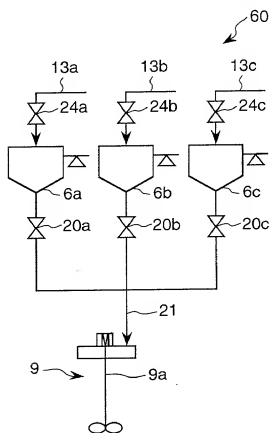


FIG. 4

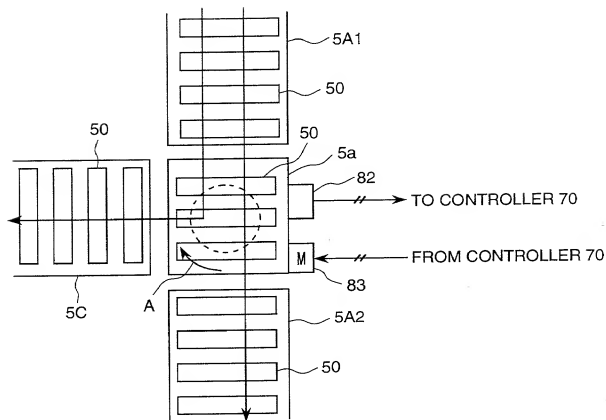
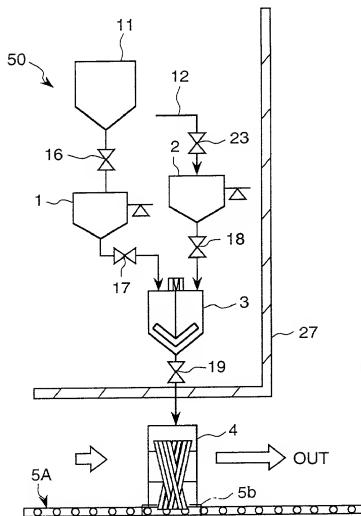


FIG. 5

(NON-RADIOACTIVE APPARATUS)



## Declaration and Power of Attorney For Patent Application

### 特許出願宣言書及び委任状

### Japanese Language Declaration

### 日本語宣言書

下記の氏名の発明者として、私は以下の通り宣言します。

As a below named inventor, I hereby declare that:

私の住所、私書箱、国籍は下記の私の氏名の後に記載されたと通りです。

My residence, post office address and citizenship are as stated next to my name.

下記の名称の発明に関して請求範囲に記載され、特許出願している発明内容について、私が最初かつ唯一の発明者（下記の氏名が一つの場合）もしくは最初かつ共同発明者である（下記の名称が複数の場合）信じています。

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

RADIOACTIVE WASTE TREATMENT FACILITY

上記発明の明細書（下記の欄で×印がついていない場合は、本書に添付）は、

The specification of which is attached hereto unless the following box is checked:

☐ 月 日に提出され、米国出願番号または特許協定条約国際出願番号を \_\_\_\_\_ とし、  
(該当する場合) \_\_\_\_\_ に訂正されました。

☐ was filed on \_\_\_\_\_  
as United States Application Number  
PCT International Application Number \_\_\_\_\_  
and was amended on \_\_\_\_\_  
(if applicable).

私は、特許請求範囲を含む上記訂正後の明細書を検討し、内容を理解していることをここに表明します。

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

私は、連邦規則法典第37編第1条56項に定義されるとおり、特許資格の有無について重要な情報を開示する義務があることを認めます。

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

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私は、米国法典第35編119条 (a) - (d) 項又は365条 (b) 項に基づき下記の、米国外の国の少なくとも一カ国を指定している特許協力条約365 (a) 項に基づく国際出願、又は外国での特許出願もしくは発明者証の出願についての外国優先権をここに主張するとともに、優先権を主張している、本出願の前に出願された特許または発明者証の外国出願を以下に、枠内をマークすることで、示している。

## Prior Foreign Application(s)

外国での先行出願

11-356466

(Number)  
(番号)

Japan

(Country)  
(国名)

15/December/1999

(Day/Month/Year Filed)  
(出願年月日)

## Priority Not Claimed

優先権主張なし



(Number)  
(番号)

(Country)  
(国名)

(Day/Month/Year Filed)  
(出願年月日)



私は、第35編米国法典119条 (e) 項に基いて下記の米国外特許出願規定に記載された権利をここに主張いたします。

I hereby claim the benefit under Title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below.

(Application No.)  
(出願番号)

(Filing Date)  
(出願日)

(Application No.)  
(出願番号)

(Filing Date)  
(出願日)

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(Application No.)  
(出願番号)

(Filing Date)  
(出願日)

(Status: Patented, Pending, Abandoned)  
(現況: 特許許可済、係属中、放棄済)

(Application No.)  
(出願番号)

(Filing Date)  
(出願日)

(Status: Patented, Pending, Abandoned)  
(現況: 特許許可済、係属中、放棄済)

私は、私自身の知識に基づいて本宣言書中で私が行なう表明が真実であり、かつ私の入手した情報と私の信じているところに基づく表明が全て真実であると信じていること、さらに故意になされた虚偽の表明及びそれと同等の行為は米国法典第18編1001条に基づき、罰金または拘禁、もしくはその両方により処罰されること、そしてそのような故意による虚偽の声明を行えば、出願した、又は既に許可された特許の有効性が失われることを認識し、よってここに上記のごく宣誓を致します。

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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委任状： 私は下記の発明者として、本出願に関する一切の  
手続きを米特許商標局に対して遂行する弁護士または代理人  
として、下記の者を指名いたします。(弁護士、または代理  
人の氏名及び登録番号を明記のこと)

POWER OF ATTORNEY: As a named inventor, I hereby appoint  
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(Supply similar information and signature for second and  
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国籍	Citizenship	
私書箱	Post Office Address	

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(Supply similar information and signature for sixth and subsequent joint inventors.)